RESEARCH MANAGEMENT DIVISION

ANNUAL REVIEW

FOR THE FISCAL YEAR

1980/81

RMD 81/6

This report may be cited as:

McLean, E., ed. 1981. Research Management Division annual review: 1980/81. Prep. for Research Management Division, Alberta Environment. RMD-81/6. 70 pp.

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INTRODUCTION

This is the first annual review for the Research Management Division (RMD) of the Department of Environment. The division was formed in April 1980, as a result of combining the former Research Secretariat of Alberta Environment with the former Alberta Oil Sands Environmental Research Program (AOSERP). AOSERP was an independent research program, established in 1975 to fund, direct, and coordinate environmental research in the Athabasca Oil Sands region of northeastern Alberta. As a result of the amalgamation, the responsibility for the management of all environmental research in Alberta Environment now resides in one division, which allows for the development of more effective and better coordinated programs.

Environmental research in the oil sands regions of the province retains a high priority, as exemplified by its annual budget of $2 000 000. A further $1 000 000 is furnished for environmental research in the non-oil sands regions.

Like its predecessor, the Research Secretariat, the Research Management Division is the research management and administration arm of the Department of Environment. It exists to assist the department in fulfilling its mandate to develop programs related to environmental protection. In this capacity, the RMD liaises and coordinates with other divisions in the department to assist in program design and program management and administration.

Utilizing the skills of a dozen scientists, the division has developed a capability to integrate with and serve the needs of other divisions in meeting their responsibilities of managing and protecting Alberta's environmental resources. The RMD also manages the

departmental library, whose staff of nine provides invaluable assistance to all researchers in Alberta Environment.

OPERATIONAL ACTIVITIES

The research strategies developed by RMD scientists have aimed at the improvement in the quality of research, and greater success in the incorporation of research results in Alberta Environment's programs and decisions.

Research funded by the RMD has been directed to specific environmental problems in the air, human, terrestrial, and water systems. The RMD supports basic research only when it is identified as necessary before applied studies can proceed. Funding has been almost exclusively by contract.

Through the means of ad hoc committees, departmental staff and other scientists have been involved in identifying environmental concerns and research programs to be funded by the RMD. An RMD scientist and a departmental staff member are usually involved in each project. Wherever possible, projects have been cofunded with other divisions or agencies. RMD scientists have also managed research projects for other divisions.

While the total divisional budget is approximately $3 000 000, actual monies spent by Alberta Environment on environmental research exceed this amount because some projects are funded by other divisions. Much of these additional funds are managed by RMD scientists. In the future, research conducted at the Alberta Environmental Centre at Vegreville will receive increasing departmental support. Relevant financial statistics are shown in the table below.

PROJECT MONIES MANAGED AND ADMINISTERED BY THE RESEARCH MANAGEMENT DIVISION

Non-Oil Sands Research*

	1979/80	1980/81
Administration	-	$280 611
Projects (RMD funds)	$355 716	$463 000
Projects (Other divisions)	$1 144 284	$1 440 244
Alberta Environmental Research Trust (direct)	$238 000	$240 000
Grants	$116 635	$116 000
Assets	-	$6 000
TOTAL	$1 854 635	$2 545 855

Oil Sands Research**

Administration	$721 452	$694 000
Projects	$2 189 748	$1 170 550
Grants	$88 800	$38 000
Assets	-	$97 450
TOTAL	$3 000 000	$2 000 000

* In 1979/80 managed by the Research Secretariat.
** In 1979/80 managed by AOSERP.

Several projects are jointly sponsored by the RMD and the energy industry; the industry's contribution is not indicated in the above table.

RMD scientists have served on many government, academic and industrial research committees, advising on research projects and evaluating projects for funding by other agencies. Participation in these committees has enhanced the effectiveness of the division and its

management capability. These activities assured that professional staff maintained an awareness of current environmental research activities in Alberta and elsewhere in Canada. RMD staff also attended and presented papers at scientific conferences and meetings in various locations in Canada and the United States. They sponsored workshops and seminars on various research topics. The division ensured that high quality reports from completed projects were published and widely distributed.

Field support staff in the division maintained operations through an office in Fort McMurray and a research facility at Mildred Lake in the Athabasca Oil Sands region. Edmonton support staff maintained office operations at a highly active level. During the year a total of 139 contracts were processed; 79 of these were research projects contracted to consulting companies and universities, and 60 were personal service or review and comment contracts. In addition, 8 research grants were awarded to Alberta universities and professional societies.

An important aspect of divisional management has been the continuing development of both technical and managerial expertise and skills of the staff. All scientists attended several conferences or seminars, and most participated in management courses. Several prepared research or policy papers, and all initiated and maintained contracts with other scientists to keep abreast of current developments in science and management.

RMD scientists annually review well over 100 research proposals submitted to or solicited by the department. Staff members also review numerous research and project reports submitted to the department or committees of which they are members.

The RMD is responsible for coordinating the development of the department's research requirements for the Alberta Environmental Centre at Vegreville (AECV), and committees established by RMD staff have identified several projects in the air and water systems. The Director of the RMD represents the department on the Technical Advisory Committee to the Centre.

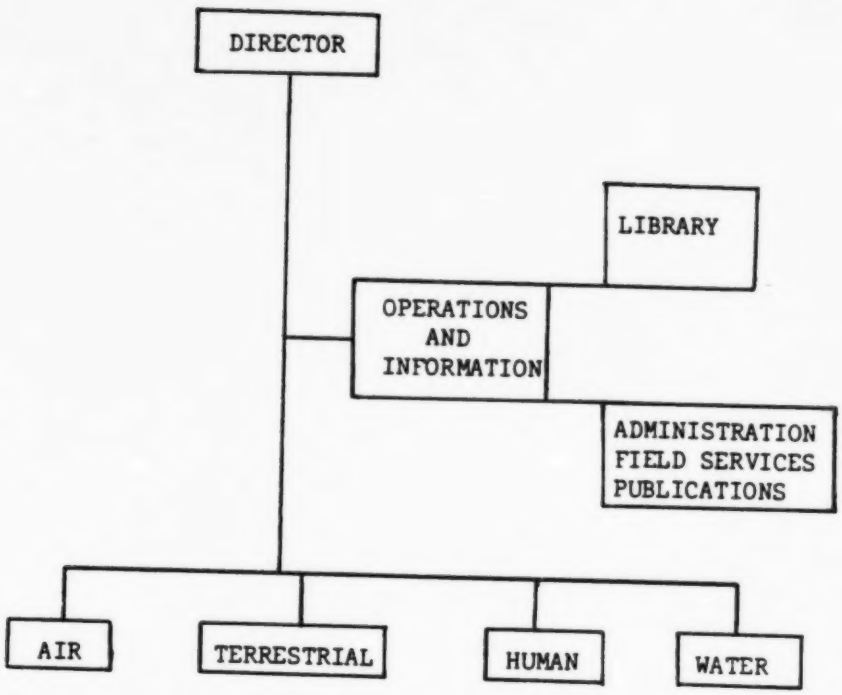
During 1980/81, the increased concern about acid emissions in eastern Canada heightened the interest of the public, industry, and government in Alberta. The RMD sustained the development of a long term research program on acid emissions, in cooperation with industry, other departments, and other governments. The Research Secretariat began work on acid forming gases in 1972, and has sponsored a series of projects as well as three workshops on related topics during the intervening years.

DIVISION ORGANIZATION

In order to effectively manage the diverse range of research programs and projects sponsored by the division, the scientific staff are organized into teams, one each in the air, human, terrestrial, and water systems. The activities of these teams are outlined in the following section of the annual review.

Full support for these scientific operations is provided by other staff working in Operations and Information. The library is a separate organizational unit headed by the departmental librarian. It provides service directly to departmental staff and the general public.

ORGANIZATIONAL CHART OF RESEARCH MANAGEMENT DIVISION



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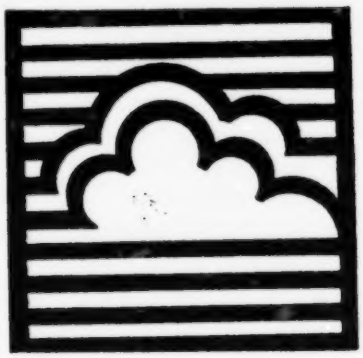

Air System

ACCOMPLISHMENTS IN THE AIR SYSTEM

In fiscal year 1980/81, the Air System research program developed in previous years was expanded to include the Alberta Oil Sands Environmental Research Program (AOSERP). The amalagation put more emphasis on developing research programs that benefit the entire province, while highlighting the oil sands study area. Interdisciplinary research continued to receive a high priority in the Air System.

In the oil sands region near Fort McMurray, baseline data continued to be collected and analysed to describe the climatology, meterology and air quality characteristics peculiar to the region. Detailed description of many of the characteristics of industrial plumes from existing oil sands mining plants were formulated and studied. To collate the above activities, computer based atmospheric models were investigated which would synthesize data and predict some aspects of air quality in the oil sands region. Quality Assurance Board, consisting of scientists from industry, government and universities, was established to provide advice and review Air System's modelling activities.

Research related to meteorology and air quality over Alberta cities continued. An integrated program to study the physics, chemistry and meteorology of particulate matter and aerosols over Edmonton and Calgary was pursued. Three of the four research projects, funded to meet the objectives of this sub-program, were completed and the final reports were published.

In fiscal year 1979/80, an ad hoc committee, with representatives from other government departments, academia, and industry, was formed to develop a set of comprehensive recommendations

on air quality and environmental health. The committee has now completed its task.

The federal government has termed acid deposition (acid precipitation) and the Long Range Transport of Atmospheric Pollutants (LRTAP) as the major environmental problem of this decade. Two major air pollutants which contribute to acid precipitation are sulphur oxides and nitrogen oxides. An inventory of nitrogen oxide emissions for Alberta has been published by the RMD; it complements a sulphur emissions inventory published earlier by the Research Secretariat.

Consultations with Saskatchewan Environment and Environment Canada were initiated to assess the regional scale transport of air pollutants in northeastern Alberta and northern Saskatchewan. This joint undertaking to study transboundary air quality and its environmental effects has recently grown to include British Columbia and Manitoba. A technical committee, with representatives from the five agencies, has been established to develop and implement acid deposition research and monitoring programs for Western Canada. The committee is chaired by an Air System research manager.

Air System team, in collaboration with Alberta Department of Energy and Natural Resources, spent considerable time preparing a provincial paper for presentation at the climate change seminar, organized by the Canadian Council of Resource and Environment Ministers. In addition, the Air System represented Alberta Environment in the steering committee set up to organize this seiminar.

PROJECTS

Airshed Management System Phase II.

Funding:	$165 788 by RMD
Managed by:	RMD
Administered by:	RMD
Status:	Nearing completion

Airborne Plume Measurements in the AOSERP Region.

Funding:	$29 960 by RMD
Managed by:	RMD
Administered by:	RMD
Status:	Completed

Central Urban and North Saskatchewan River Valley Air Pollution Study.

Funding:	$14 300 by RMD
Managed by:	RMD
Administered by:	RMD
Status:	Nearing completion

Doppler Sounder Measurements of Calgary Wind Climatology.

Funding:	$15 000 by RMD
Managed by:	RMD
Administered by:	RMD
Status:	Ongoing

Dry Deposition of SO_2.

Funding:	$75 000 by Pollution Control Division
Managed by:	Pollution Control Division and RMD
Administered by:	RMD
Status:	Ongoing

Gregoire Lake Environmental Study.

Funding:	$40 000 by Alberta Environment
Managed by:	RMD and Amoco Canada Ltd.
Administered by:	RMD
Status:	Ongoing

Meteorology and Air Quality Data Acquistion

Funding:	$139 660 by RMD
Managed by:	RMD and Pollution Control Division
Administered by:	RMD and Pollution Control Division
Status:	Ongoing

Modelling of Low-Level Winds and Temperatures.

Funding:	$11 000 by Pollution Control Division
Managed by:	RMD
Administered by:	Pollution Control Division
Status:	Nearing Completion

Peroxyacetyl Nitrate in the Calgary Atmosphere.

Funding:	$42 000 by RMD
Managed by:	RMD
Administered by:	RMD
Status:	Ongoing

Problem Analysis of Regional Scale Transport of Air Pollutants in N.E. Alberta and North Saskatchewan River.

Funding:	$45 000 by RMD, Saskatchewan Department of Environment, and Environment Canada.
Managed by:	Technical Committee chaired by Air System manager
Administered by:	Technical Committee chaired by Air System manager
Status:	Completed

Snowpack Survey and Winter Pollutant Deposition Patterns in the AOSERP Study Area.

Funding:	$38 000 by RMD
Managed by:	RMD
Administered by:	RMD
Status:	Nearing completion

PUBLICATIONS

Bagg, D. 1980. Validation studies of the CRSTER model in application to the AOSERP study area. Prep. for AOSERP by Atmospheric Environment Service, Environment Canada. AOSERP O.F. 22. 35 pp.

Barrie. L.A., and J. Kovalick. 1980. A wintertime investigation of the deposition of pollutants around an isolated power plant in northern Alberta. Prep. for AOSERP by Atmospheric Environment Service, Environment Canada. AOSERP Report 90. 115 pp.

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Davison, D.S., and R.B. Lantz. 1980. Review of requirements for air quality simulation models. Prep. for AOSERP by Intera Environmental Consultants Ltd. Calgary, Alberta. AOSERP Report 104. 86 pp.

Denison, P.J. 1980. Pollution deposition field study plan. Prep. for AOSERP by Acres Consulting Services Ltd. AOSERP O.F. 17. 82 pp.

Fanaki, F. 1979. Air system summer field study in the AOSERP study area, June 1977. Prep. for AOSERP by Atmospheric Environment Service, Environment Canada. AOSERP Report 68. 248 pp.

Grandia, K.L. 1981. Feasibility study of airborne hi-volume filter sampling for particulate matter. Alberta Environment, Edmonton, Alberta. 53 pp.

Harrison, A.W., and C.V. Mathai. 1981. Particulate air pollution and visibility over Calgary. Alberta Environment, Edmonton, Alberta. 99 pp.

Murray, W., and T. Low. 1979. An observational study of fog in the AOSERP study area. Prep. for AOSERP by Promet Environmental Group Ltd. AOSERP Report 86. 54 pp.

Padro, J., and D. Bagg. 1980. Application of the CRSTER model to the Alberta oil sands region. Prep. for AOSERP by Atmospheric Environment Service, Environment Canada. AOSERP O.F. 21. 35 pp.

Peake, E. 1981. A preliminary study of the chemical composition of particulate matter and aerosols over Calgary. Alberta Environment, Edmonton, Alberta. 56 pp.

Peters, R.R., and H.S. Sandhu. 1981. Nitrogen oxides emissions for Alberta 1976-1979. Alberta Environment, Edmonton, Alberta. 12 pp.

Strosher, M.M., and R.R. Peters. 1980. Meteorological factors affecting ambient SO_2 concentrations near an oil sands extraction plant. Prep. for AOSERP by Pollution Control Division, Alberta Environment. AOSERP Report 106. 87 pp.

Venkatram. A. 1980. Evaluation of the effects of convection on plume behaviour in the AOSERP study area. AOSERP Report 95. 75 pp.

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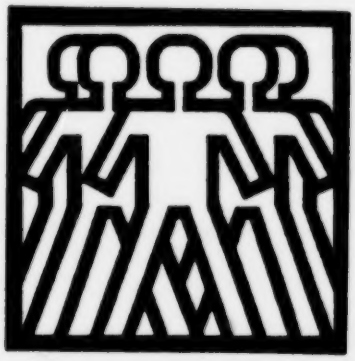

Human System

ACCOMPLISHMENTS IN THE HUMAN SYSTEM

The amalgamation of the Research Secretariat and the Alberta Oil Sands Environmental Research Program did not affect the impetus of the Human System's routine operations, which continued without interruption.

In the oil sands component of the Human System, a summary of AOSERP research done during the last five years was undertaken. With the hiring of a new research manager in January 1981, a review of specific program objectives for the future was initiated. There are now two research managers in the Human System.

In the non-oil sands component of the Human System, the concept document is being refined with the operationalization of the objectives and the infusion of those objectives into a research management framework. In-house client groups have continued to fall under the four major program areas outlined for the Human System in the previous fiscal year. These are: (1) social impact assessment, including public participation; (2) environmental education; (3) human-environment relationships; and (4) research management--policy and implementation.

In the area of social impact assessment, Human System contributions include acting as program coordinator for the Alberta Conference on the Human Side of Energy, to be held in Edmonton in August 1981. The conference has arisen from interest shown and papers presented at a similar conference held in Laramie, Wyoming, in July 1980. A Workshop on Social Impact Assessment and Energy Development was held in Edmonton in March 1981 under the sponsorship of the Human

System. Outside expertise has assisted the Human System in identifying other social impact areas of concern.

Activities in the environmental education area consisted primarily of serving as technical advisor to the Alberta Environment Communications Branch on the evaluation of environmental education kits used by teachers.

The program on human-environment relationships has two sub-programs. One is environmental health, and has involved Human System representation on the committees on Air Quality and Health, which bring together representatives of industry and provincial government. The other sub-program concerns environmental attitudes. Here, the Human System continued the inclusion of environmental questions in the Edmonton Area Survey, carried out by the Population Research Laboratory of the University of Alberta.

The last program area research management--policy and implementation, includes one on-going study on a framework for Human System research. A Human System research manager also presented a paper on legislation, environmental protection, and quality of life issues, to the Workshop on Sanitary Landfill Research held in February 1981 at the Alberta Environmental Centre in Vegreville.

PROJECTS

A Study of Human Adjustment in Fort McMurray.

Funding:	$45 000 by RMD
Managed by:	RMD
Administered by:	RMD
Status:	Nearing completion

Edmonton Area Environmental Survey.

Funding:	$3 000 by RMD and Environment Council of Alberta
Managed by:	RMD
Administered by:	RMD
Status:	Ongoing

Human System Research Management Framework.

Funding:	$10 000 by RMD
Managed by:	RMD
Administered by:	RMD
Status:	Nearing completion

Social Costing and Environment: A Compendium and Analysis of the Implications for Alberta Environment.

Funding:	$13 000 by RMD
Managed by:	RMD
Administered by:	RMD
Status:	Completed

Social Impact Assessment and Energy: Workshop.

Funding:	$4 500 by RMD
Managed by:	RMD
Administered by:	RMD
Status:	Completed

PUBLICATIONS

Edwards, F.N. Public Participation in Community Planning. Presented at the Conference on the Human Side of Energy, Laramie, Wyoming, July 7, 1980.

Edwards, F.N. Social Impact Assessment: A Retrospective Case Study. Presented at the Conference on the Human Side of Energy, Laramie, Wyoming, July 7, 1980.

Edwards, F.N. Sanitary Landfill--Legislation, Environmental Protection and Quality of Life Issues. Presented at the Workshop on Sanitary Landfill Research, Vegreville, Alberta, February 18, 1981.

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Terrestrial System

ACCOMPLISHMENTS IN THE TERRESTRIAL SYSTEM

1980/81 represented the fifth fiscal year that Alberta Environment supported environmental research, on a program basis, in the Athabasca Oil Sands region of Alberta (the program formerly known as Alberta Oil Sands Environmental Research Program). Initial objectives of the AOSERP specified that baseline studies were to be completed within the first 3 to 5 years, and during the subsequent 5 years emphasis would be on applied research. The applied research areas were to be identified during the initial 5 years of the program, which terminated in the fiscal year 1979/80.

The projects funded and managed by the Terrestrial System during 1980/81 relected the new five-year phase, and the concomitant redirection of program planning.

The Soils Inventory was the final baseline project remaining in the Terrestrial System from the previous years; it was completed by 31 March 1981. The remainder of the projects conducted by the system under the Oil Sand Program funding reflected the planned change in emphasis to applied research, and included studies on the impact of aerial emissions on vegetation and soils; ecosystem simulation modelling, involving integration, interpretation, and evaluation of the data generated during the initial five years of AOSERP; and ecosystem monitoring, including establishment of permanent sample plots.

In the near future, the RMD will co-sponsor an Alberta Oil Sands Technology and Research Authority professorship, which will bring to Alberta for a three year term Dr. C. Pielou, a noted ecosystem modeller from Dalhousie University in Halifax, Nova Scotia. She will

teach at the University of Lethbridge and carry out research on environmental problems in the Athabasca Oil Sands region.

Finally, during 1980/81, 32 reports related to research activities of the Terrestrail System in the Athabasca Oil Sands region of Alberta were published.

Outside the oil sands area, reclamation research within Alberta Environment was coordinated by the Reclamation Research Coordinating Committee, chaired by a Terrestrial System scientist. A Terrestrial System scientist continued essentially full time managerial and administrative responsibilities for reclamation research in association with the inter-departmental Reclamation Research Technical Advisory Committee (RRTAC). In 1980, RRTAC committed approximately $1.5 million to a reclamation research program, with sub-programs in the north-east oil sands region, in the coal-bearing region of the province's agricultural zone, and in the mountains and foothills.

A Terrestrial System research manager was chairman of one session during the two-day Reclamation Research Seminar, held at the Chateau Lacombe in Edmonton in March 1981.

A review of reclamation research for Alberta was conducted by the Terrestrial System. To date, a bibliography of some 2000 references has been prepared. All references have been reviewed for content, abstracted, and a summary report is being prepared. The bibliography will have a computer search capability.

The Canadian Land Reclamation Association Newsletter was edited by a Terrestrial System research manager.

Visiting scientist programs were initiated in 1980 through the efforts of the Terrestrial System. Dr. Beverly Ausmus, Senior Research Ecologist at Battelle Laboratories in Columbus, Ohio, spent two weeks in

Edmonton at the invitation of the RMD. Dr. Ausmus participated in the Workshop on Sanitary Landfill Research, held at the Alberta Environmental Centre in Vegreville in February 1981, presented three seminars on relevant environmental topics, and entered into productive discussion sessions with department, industry, and academic scientists.

PROJECTS

Adaptation of Reclamation Bibliography to Spires Computer Program.

Funding:	$7 670 by Land Conservation and Reclamation Council (Heritage Trust Savings Fund)
Managed by:	RMD
Administered by:	RMD
Status:	Nearing completion.

Battle River Reclamation Research Project.

Funding:	$100 000 (fiscal year 1980/81), by Land Conservation and Reclamation Council (Heritage Trust Savings Fund); Alberta Power; Luscar Ltd.; and Manalta Coal Ltd.
Managed by:	RMD
Administered by:	RMD
Status:	Completed

Chemical Characterization of Bottom and Fly Ash from Alberta Power Stations.

Funding:	None other than salaries, by Earth Sciences Division
Managed by:	Earth Sciences Division and RMD
Administered by:	RMD
Status:	Completed

Complexity and Stability of Young, Mature and Old Forests on Picea glauca, Picea mariana, Pinus banksiana Habitat Types in the Boreal Forest Region of Albert (Permanent Sample Plot Location).

Funding:	$8 000 by RMD
Managed by:	RMD
Administered by:	RMD
Status:	Ongoing

Distribution and Relative Sensitivity to Acidification of Soils of the Sand River Area, Alberta.

Funding:	$31 700 by RMD and CPA
Managed by:	RMD
Administered by:	RMD
Status:	Completed

Feasibility of Genetic Improvement of Native Alberta Grasses.

Funding:	$151 000 (fiscal year 1980/81), by Land Conservation and Reclamation Council (Heritage Trust Savings Fund), and Parks Canada.
Managed by:	RMD and Parks Canada
Administered by:	RMD and Parks Canada
Status:	Ongoing

Impact of Air Pollutant Mixtures Characteristic of Oil Sands Operations on Forest Vegetation and Soils.

Funding:	$70 000 by RMD
Managed by:	RMD
Administered by:	RMD
Status:	Ongoing

Investigation of Chemical, Physical and Biological Parameters in Stored Topsoil.

Funding:	$15 000 (fiscal year 1980/81), by Land Conservation and Reclamation Council (Heritage Trust Savings Fund), and RMD
Managed by:	Earth Sciences Division and RMD
Administered by:	RMD
Status:	Ongoing

Marmot Experimental Watershed Twin Sub Basin Clearcut.

Funding:	None in fiscal year 1980/81
Managed by:	RMD and Alberta Forest Service
Administered by:	RMD and Alberta Research Council
Status:	Ongoing

Nitrogen Uptake of Native Alberta Grasses.

Funding:	None in fiscal year 1980/81
Managed by:	RMD
Administered by:	RMD
Status:	Completed

Oil Sands Soil Reclamation Project.

Funding:	$3 000 by Oil Sands Environmental Study Group and Land Conservation and Reclamation Council (Heritage Trust Savings Fund)
Managed by:	Combined Government/Industry Steering Committee
Administered by:	RMD
Status:	Ongoing

Plant Nutrients, Agronomic Potential of Coal Ash.

Funding:	None other than salaries, by Earth Sciences Division
Managed by:	RMD and Earth Sciences Division
Administered by:	RMD
Status:	Completed

Post-Development Environmental Impact Assessment of a Resource Development in Alberta.

Funding:	$11 000 (fiscal year 1980/81), by RMD
Managed by:	RMD
Administered by:	RMD
Status:	Nearing completion

Problem Analysis of Cryptogoms as Biomonitors of Air Pollution in Alberta.

Funding:	$7 540 by RMD
Managed by:	RMD
Administered by:	RMD
Status:	Nearing completion

Publication of: Schiechtl, H.M. "Bioengineering for Land Reclamation." University of Alberta Press.

Funding:	$1 000 (fiscal year 1980/81), by RMD
Managed by:	RMD
Administered by:	RMD
Status:	Completed

Radioactivity in Fly and Bottom Ash.

Funding:	None other than salaries, by Earth Sciences Division
Managed by:	RMD and Earth Sciences Division
Administered by:	RMD
Status:	Completed

Reclamation Literature Review.

Funding:	$1 500 (fiscal years 1980/81), by Land Conservation and Reclamation Council (Heritage Trust Savings Fund)
Managed by:	RMD
Administered by:	RMD
Status:	Ongoing

Reinstatement of Biological Activity in Devastated Soils.

Funding:	$119 000 (fiscal years 1980/81), by Land Conservation and Reclamation Council (Heritage Trust Savings Fund)
Managed by:	RMD
Administered by:	RMD
Status:	Ongoing

Soils Inventory of AOSERP Study Area.

Funding:	$58 880 by RMD
Managed by:	RMD
Administered by:	RMD
Status:	Nearing completion

Statistical Analysis of Heavy Metal Concentrations in Small Rodent Tissue.

Funding:	$4 800 by RMD
Managed by:	RMD
Administered by:	RMD
Status:	Completed

Survey of Reclamation Activities in Alberta.

Funding:	$2 600 by Land Conservation and Reclamation Council (Heritage Trust Savings Fund)
Managed by:	RMD
Administered by:	RMD
Status:	Nearing completion

PUBLICATIONS

Addison, P.A. 1980. Baseline conditions of jack pine biomonitoring plots in the Athabasca Oil Sands area; 1976 and 1977. Prep. for AOSERP by Canadian Forestry Service, Environment Canada. AOSERP Report 98. 43 pp.

Addison, P.A. 1980. Ecological bench-marking and biomonitoring for detection of airborne pollutant effects on vegetation and soils. Prep. for AOSERP by Northern Forest Research Centre, Canadian Forestry Service. AOSERP Report 111. 48 pp.

Baker, J. 1980. Differences in the composition of soils under open and canopy conditions at two sites close-in to the Great Canadian Oil Sands Operation, Fort McMurray, Alberta. Prep. for AOSERP by Northern Forest Research Centre. AOSERP Report 97. 24 pp.

Beaver, R., and M. Ballantyne. 1979. Breeding distribution and behaviour of the White Pelican in the Athabasca Oil Sands area. Prep. for AOSERP by Canadian Wildlife Service. AOSERP Report 82. 93 pp.

Ealey, D. 1979. The distribution, foraging behaviour, and allied activities of the White Pelican in the Athabasca Oil Sands area. Prep. for AOSERP by Canadian Wildlife Service. AOSERP Report 83. 69 pp.

Eulert, G.K., and H. Hernandez. 1980. Synecology and autecology of boreal forest vegetation in the Alberta Oil Sands Environmental Research Program study area. Prep. for AOSERP by Intedisciplinary Systems Ltd. AOSERP Report 99. 184 pp.

Francis, J., and K. Lumbis. 1979. Habitat relationships and management of terrestrial birds in northeastern Alberta. Prep. for AOSERP by Canadian Wildlife Service. AOSERP Report 78. 365 pp.

Fuller, T.K., and L.B. Keith. 1980. Woodland caribou population dynamics in north-eastern Alberta. Prep. for AOSERP by Department of Wildlife Ecology, University of Wisconsin. AOSERP Report 101. 63 pp.

Fuller, T.K., and L.B. Keith. 1980. Wolf population dynamics and prey relationships in northeastern Alberta. Prep. for AOSERP by Department of Wildlife Ecology, University of Wisconsin. AOSERP Report 102. 58 pp.

Green, J.E. 1979. The ecology of five major species of small mammals in the AOSERP study area: a review. Prep. for AOSERP by LGL Ltd. Environmental Research Associates. AOSERP Report 72. 103 pp.

Green, J.E. 1979. Baseline states of small mammal populations in the AOSERP sutdy area. Interim report II. Prep. for AOSERP by LGL Ltd. Environmental Research Associates. AOSERP O.F. 6. 137 pp.

Green, J.E. 1980. Small mammal populations of northeastern Alberta. I. Populations in natural habitats. Prep. for AOSERP by LGL Ltd. Environmental Research Associates. AOSERP Report 107. 294 pp.

Green, J.E. 1980. Small mammal populations of northeastern Alberta. II. Populations in reclamation areas. Prep. for AOSERP by LGL Ltd. Environmental Research Associates. AOSERP Report 108. 136 pp.

Green, J.E. 1980. Interim report of an experimental approach to the biological control of small mammal damage to woody plants; 1978 studies. Prep. for AOSERP by LGL Environmental Research Associates. AOSERP O.F. 8. 81 pp.

Hardy Associates (1978) Ltd. 1980. Evaluation of AOSERP reclamation research progress and needs. Prep. for AOSERP by Hardy Associates (1978) Ltd. AOSERP O.F. 19. 178 pp.

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Original filed with camera-ready
1981-82 Ann. Rev. (82-11

Water System

ACCOMPLISHMENTS IN THE WATER SYSTEM

Fiscal year 1980/81 was devoted largely to the completion of outstanding projects from previous years in both oil sands and non-oil sands related research. A more holistic view of environmental studies was developed from a manifesto delivered by a Water System manager at the Alberta Society of Professional Biologists' 1979 Symposium. An aquatic contaminants program and a water system conceptual model were developed during the year. The outline for the conceptual model was presented at a seminar in the Department of Civil Engineering at the University of Alberta, while the outline for the contaminants program was presented to the 6th Annual Symposium on Aquatic Toxicology, in Boulder, Colorado.

In cooperation with the Groundwater Branch and the Geotechnical Branch, a series of phased studies related to slope stability in both consolidated and unconsolidated materials were begun.

A program of research into induced seismicity related to fluid injection at Cold Lake, Alberta, was initiated in cooperation with the Groundwater Branch. A passive seismic monitoring array was constructed, and plans were made in cooperation with industry to carry out a controlled cold water injection experiment, which will be used to help understand the mechanics of fracturing in oil sands and their relationship to felt earth tremors.

Water quality monitoring was continued in the Athabasca Oil Sands. Data was catalogued for the Athabasca River at the McMurray and Embarras gauges and for Gregoire Lake. The effects of water quality of biota were also examined in the Peace and Athabasca River systems. A Water System manager participated in the management of the Plains

Hydrology Program associated with reclamation research in the Forestburg area.

Seminars on a variety of subjects were sponsored following receipt of completed reports. Amongst these were the stability of Turtle Mountain, sediment and water mixing patterns in the Athabasca Delta, groundwater modelling, assimilative capacity of the Athabasca River below McMurray, and others.

A water system manager chaired a Workshop on Sanitary Landfill Research, which was held in cooperation with the Alberta Environmental Centre, Vegreville, to assist with advance planning in waste management research. The workshop identified three priority topics for intensive study in 1981/82: environmental risk assessment--comparing dumps with sanitary landfills, protocol for reclamation, and determination of the optimum rate of return of landfill sites to other productive use.

Environmental risk assessment processes have been also identified by the Water System teams as the most active area for research in the coming year. The contaminants program and the water system conceptual model are both rooted in this research area.

PROJECTS

Analysis of Organic Pollutants in Leachate from Edmonton Sanitary Landfill Sites.

Funding:	Nil in fiscal year 1980/81
Managed by:	RMD
Administered by:	RMD
Status:	Completed

Alsands Muskeg Monitoring Cooperative.

Funding:	$25 000 by RMD
Managed by:	RMD
Administered by:	RMD
Status:	Nearing completion

An Assessment of Benthic Secondary Production in the Muskey River of Northeastern Alberta.

Funding:	$61 000 by RMD
Managed by:	RMD
Administered by:	RMD
Status:	Completed

Assimilative Capacity--Athabasca River Watershed Management Model.

Funding:	$8 800 by RMD
Managed by:	RMD
Administered by:	RMD
Status:	Nearing completion

Chlorine Stress Assessment Using a Field Respiration/Community Metabolism Technique.

Funding:	$18 000 (fiscal year 1980/81), by RMD
Managed by:	RMD
Administered by:	RMD
Status:	Nearing completion

Compilation of Stream Gauging Data, 1979.

Funding:	$60 000 by RMD and Technical Services Division
Managed by:	RMD and Technical Services Division
Administered by:	RMD
Status:	Completed

A Comparative Study of Benthic Algal Primary Productivity in the AOSERP Study Area.

Funding:	$106 400 by RMD
Managed by:	RMD
Administered by:	RMD
Status:	Completed

Cooperative Program in Surface Water Engineering Research.

Funding:	$66 000 (fiscal year 1980/81), by RMD
Managed by:	RMD and Technical Services Divison
Administered by:	RMD
Status:	Continuing support to the Alberta Research Council

Distribution and Circulation of Water and Sediment in the Athabasca River Delta Area.

Funding:	$85 000 by RMD
Managed by:	RMD
Administered by:	RMD
Status:	Completed

Effects of Exploration Seismograph Activity on Domestic Water Wells.

Funding:	Nil in fiscal year 1980/81
Managed by:	RMD
Administered by:	RMD
Status:	Completed

An Electrophysiological Investigation fo the Effects of Toxicants on Fish Skeletal Muscle.

Funding:	$5 000 (fiscal year 1980/81), by RMD
Managed by:	RMD
Administered by:	RMD
Status:	Nearing completion

Environmental Effects of Coal Mining on Ground Waters at the Whitewood Mine.

Funding:	$26 000 (fiscal year 1980/81), by RMD
Managed by:	RMD and Earth Sciences Division
Administered by:	RMD
Status:	Completed

Fluvial Sediment Transport in the Elbow River.

Funding:	$18 000 (fiscal year 1980/81), by RMD and Technical Serivces Division
Managed by:	RMD and Technical Services Division
Administered by:	RMD
Status:	Completed

Grant-in-Aid for Water Quality Research: Kananaskis Environmental Research Centre Organic Water Quality in the Marmot Basin and the Red Deer Basin.

Funding:	Nil in fiscal year 1980/81
Managed by:	RMD and Environment Canada
Administered by:	RMD and Environment Canada
Status:	Completed

Inventory of Groundwater Flow and Chemistry Model.

Funding:	$7 787 by RMD
Managed by:	RMD
Administered by:	RMD
Status:	Nearing completion

A Longitudinal Physico-Chemical and Algal Survey of Five Rivers Running Through the AOSERP Study Area.

Funding:	$7 300 by RMD
Managed by:	RMD
Administered by:	RMD
Status:	Completed

Maximum Possible Flood.

Funding:	Nil in fiscal year 1980/81
Managed by:	Technical Services Division
Administered by:	RMD
Status:	Completed

The Metabolism of Selected Carbon Compounds in the Athabasca River.

Funding:	$57 650 by RMD
Managed by:	RMD
Administered by:	RMD
Status:	Completed

Microbial Ecology of the Red Deer River, Alberta.

Funding:	Nil in fiscal year 1980/81
Managed by:	RMD and Environment Canada
Administered by:	RMD and Environmental Canada
Status:	Completed

Oil Sands in Situ Combustion Products.

Funding:	$100 000 by RMD and AOSTRA
Managed by:	RMD
Administered by:	RMD
Status:	Nearing completion

Radiocarbon Uptake Analysis.

Funding:	$8 000 by Pollution Control Division
Managed by:	Pollution Control Division
Administered by:	RMD
Status:	Nearing completion

Regimal Water Quality Data Collection for the Athabasca Oil Sands Area. Volume III.

Funding:	$111 062 by RMD and Pollution Control Division
Managed by:	RMD
Administered by:	RMD
Status:	Ongoing

Sanitary Landfill Research Program.

Funding:	$2 000 (fiscal year 1980/81), by RMD and Pollution Control Division
Managed by:	Pollution Control Division
Administered by:	RMD
Status:	Ongoing

Scour and Transport of Coarse River Bed Material.

Funding:	$11 000 by RMD and Technical Services Division
Managed by:	Technical Services Division (River Engineering Branch)
Administered by:	RMD
Status:	Nearing completion

Spring Runoff from Prairie Streams as Influenced by Climatological and Physiographic Conditions.

Funding:	$16 000 (fiscal year 1980/81), by Technical Services Division
Managed by:	RMD and Technical Services Division
Administered by:	RMD
Status:	Completed

The Significance of Heavy Metals to the Activated Sludge Process.

Funding:	$15 000 (fiscal year 1980/81), by RMD and Standards and Approvals Division
Managed by:	RMD and Standards and Approvals Division
Administered by:	RMD
Status:	Nearing completion

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Thorson, K.M. 1980. Interim compilation of stream gauging data, 1979. Prep. for AOSERP by Water Survey of Canada, Environment Canada. AOSERP Project WS 1.1. 63 pp.

Tripp, D.B., and P.J. McCart. 1979. Investigations of the spring spawning fish population in the Athabasca and Clearwater rivers upstream from Fort McMurray. Volume I. Prep. for AOSERP by Aquatic Environments Ltd. AOSERP Report 84. 128 pp.

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Verschuren, J.P., and L. Wojtiw. 1980. Estimate of the maximum probable precipitation for Alberta. Research Management Division, Edmonton. 307 pp.

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Intersystem

INTERSYSTEM

Environmental science cannot readily be segmented into rigid administrative packages, but represents a continuum relationship amongst the lithosphere, hydroshpere, atmosphere and biosphere. In recognition of these interrelations, the RMD pursues lines of inquiry that transcend the system structure imposed on management of research programs by administrative considerations.

In fiscal year 1980/81, the RMD (acting on behalf of Environmental Protection Services) completed the development and management of a project which examined departmental waste management strategies for the 1980s. RMD staff have been involved with research on one component of waste management--sanitary landfills--for several years, in association with the Earth Sciences Division. Althogether, three projects were coordinated with the Earth Sciences and Pollution Control divisions.

In February 1981, a Workshop on Sanitary Landfill Research was held at the Alberta Environmental Centre in Vegreville. Over 50 participants attended, representing municipal, provincial, and federal governments, universities and private industries, and a dozen papers were presented.

The work of APIGEC/SCAGE (Alberta Petroleum Industry Government Committee/Steering Committee on Acid Gases in the Environment) continued. The committee is a government/industry body whose purpose is to recommend research projects concerning the effects of acid gases on the environment. In 1980/81, the committee was chaired by a Terrestrial System research manager. Dr. Allan Legge, of the Kananaskis Centre for Environmental Research, University of Calgary, was

contracted to act as a facilitator to APIGEC, its Steering Committee and subcommittees.

The Director of the RMD represented Alberta Environment on the Lake Wabamun Watershed Advisory Committee, established to examine land and water management practices affecting the quality of Lake Wabamun, and to make recommendations to the Minister. The Director was responsible for developing terms of reference for the committee. He was an acting chairman of APIGEC/SCAGE; a divisional representative for AECV Technical Advisory Committee; departmental representative on the Kananaskis Policy and Advisory Committee, University of Calgary; and departmental representative for the APIGEC/Oil Sands Subcommittee.

In June, the Director attended the Alberta Oil Sands Technology and Research Authority's conference on non-conventional oil, held in Calgary. In August, he presented a divisional paper on oil sands research at the American Chemical Society's conference in Las Vegas, Nevada.

Finally, in November, the Director attended one meeting of the National Research Council Associate Committee on Scientific Criteria for Environmental Quality, held in Ottawa. While there, he met with representatives from Statistics Canada, Ministry of State for Science and Technology, the Transport Commission, and the Science Council.

PROJECTS

Alberta Oil Sands Environmental Research Program. 5-Year Report: Review and Revision.

Funding:	$14 000 by RMD
Managed by:	RMD
Administered by:	RMD
Status:	Nearing completion

Assessment of Reclamation Potential and Hydrologic Impacts of Large-Scale Surface Mining of Coal in Plains Areas of Alberta.

Funding:	$950 166 by Land Conservation and Reclamation Council (Heritage Trust Savings Fund)
Managed by:	RMD Chairs Steering Committee
Administered by:	RMD
Status:	Ongoing

Biogeochemistry of Organic Compounds in Water Quality: Impact of Coal Operations

Funding:	$125 134 by Land Conservation and Reclamation Council (Heritage Trust Savings Fund)
Managed by:	RMD Chairs Steering Committee
Administered by:	RMD
Status:	Ongoing

Cold Lake Induced Seismicity Program. Phase I: Array Construction.

Funding:	$180 000 by RMD, Earth Sciences Division, and Esso Resources
Managed by:	RMD and Earth Sciences Division
Administered by:	Earth Sciences Division
Status:	Nearing completion

Environmental Quality and the Oxides of Nitrogen Near Selected Compressor Installations in Alberta.

Funding:	$89 661 by RMD
Managed by:	RMD
Administered by:	RMD
Status:	Ongoing

Modelling Workshop.

Funding:	$42 000 by RMD
Managed by:	RMD
Administered by:	RMD
Status:	Nearing completion

Selected Runs of the Airshed Management System Gaussian Frequency Distribution Model.

Funding:	$4 000 by RMD
Managed by:	RMD
Administered by:	RMD
Status:	Completed

Weather Radar Information for Operational Meteorology.

Funding:	$30 000 by RMD and Technical Services Division
Managed by:	RMD
Administered by:	RMD
Status:	Completed

PUBLICATIONS

Johnson, M.R., R.G. Humphries, B.L. Barge, and J. Ramsden. 1981. A design for facilities to provide weather radar information for use in operational hydrology. Alberta Research Council, Edmonton. 51 pp.

Wallis, P., E. Peake, M. Strosher, B. Baker, and S. Telang. 1980. The assimilative capacity of the Athabasca River for organic compounds. Prep. for AOSERP by the Kananaskis Centre for Environmental Research, University of Calgary. AOSERP Project WS 2.3.2. 106 pp.

Original with camera ready
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Committees

COMMITTEES

Committees with Secretariat representation are listed below.

DEPARTMENTAL COMMITTEES

Acid Deposition Committee; Chairperson

Ad Hoc Committee - Air Quality and Environmental Health; Chairperson and Secretary

Ad Hoc Committee on the Water System; Chairperson

Environmental Protection Services Directors/Assistant Deputy Minister Committee

Library Committee

Quality Assurance Board, Airshed Management System (RMD)

Reclamation Research Coordinating Committee; Chairperson

Waste Management Research Committee; Chairperson

INTERDEPARTMENTAL COMMITEES

Alberta Fishways

Alberta Government Libraries Council

Alberta Watershed Research Program Steering Committee

Aquaculture Committee

Lake Wabamun Scientific Advisory Committee

Oil Sands Development and Reclamation Model Study Steering Committee

Reclamation Research Technical Advisory Committee

Research and Development Technical Advisory Committee, Alberta Environmental Laboratory at Vegreville

SCI/TECH Data Bank Committee

INTERAGENCY COMMITTEES

Advisory Committee, Faculty of Environmental Design (University of Calgary)

Advisory Committee for International Symposium on Acoustic Remote Sensing of the Atmospheres and Oceans, Calgary, 1981

Air Pollutants Effects - Phase II

APIGEC/SCAGE Sub Committee on Animal and Human Health

Atmospheric Sciences Program Committee (Alberta Research Council)

Climate Change Seminar Steering Committee

Environmental Research Advisory Council (Canadian Petroleum Association)

Federal/Provincial Long Range Transport of Air Pollutants (LRTAP) Science Committee (Environment Canada)

Fisheries Subcommittee, Peace Athabasca Implementation Committee.

Forest Development Research Trust Advisory Council

Grants Advisory Committee (Alberta Environmental Research Trust)

Human Side of Energy Conference Committee; Chairperson

Inland Waters Directorate (Environment Canada)

Joint OSESG/RRTAC Soils Recoustraction Sub- committee - Oil Sands

Kananaskis Centre for Environmental Research Policy and Advisory Committee

Monitoring Committee, Peace Athabasca Implementation Committee

Native Shrub Research Committee (Oil Sands Environmental Study Group - Reclamation Research Technical Advisory Committee)

Organization Committee; 9th Annual Aquatic Toxicology Workshop.

Panel on Hydrogen Sulphide in the Canadian Atmosphere - Associate Committee on Scientific Criteria for Environmental Quality (National Research Council); Chairperson

Peace Athabasca Delta Monitoring Committee (Department of the Environment, Department of Energy and Natural Resources, Environment Canada)

Peace Athabasca Implementation Committee: Secretary

Plains Aquatic Research Group; Secretary

Planning Committee, Conference on Computer Simulation Modelling of Socioecomonic Impacts (University of Alberta)

Policy and Advisory Committee, Kananaskis Centre for Environmental Research (University of Calgary)

Prairie Provinces Water Board

Statistical Coordinating Committee

Steering Committee on Acid Gases in the Environment (Alberta Petroleum Industry/Government Environmental Committee); Chairperson

Subcommittee on Air - Associate Committee on Scientific Criteria for Environmental Quality (National Research Council)

Surface Water Research Advisory Committee (Alberta Research Council and the Department of the Environment)

Technical Committee - Transboundary Movement of Air Pollutants (Environment Canada, Saskatchewan Environment and Alberta Environment); Chairperson

Technical Advisory Committee, Solar and Wind Energy Research Programs (Alberta Research Council)

Terrestrial/Aquatic Subcommittee of APIGEC/SCAGE;

U.S. Canada Transboundary Air Pollution Impact Assessment Group

INTERAGENCY COMMITTEES

Advisory Committee, Faculty of Environmental Design (University of Calgary)

Advisory Committee for International Symposium on Acoustic Remote Sensing of the Atmospheres and Oceans, Calgary, 1981

Air Pollutants Effects - Phase II

APIGEC/SCAGE Sub Committee on Animal and Human Health

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Grants Advisory Committee (Alberta Environmental Research Trust)

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Policy and Advisory Committee, Kananaskis Centre for Environmental Research (University of Calgary)

Prairie Provinces Water Board

Statistical Coordinating Committee

Steering Committee on Acid Gases in the Environment (Alberta Petroleum Industry/Government Environmental Committee); Chairperson

Subcommittee on Air - Associate Committee on Scientific Criteria for Environmental Quality (National Research Council)

Surface Water Research Advisory Committee (Alberta Research Council and the Department of the Environment)

Technical Committee - Transboundary Movement of Air Pollutants (Environment Canada, Saskatchewan Environment and Alberta Environment); Chairperson

Technical Advisory Committee, Solar and Wind Energy Research Programs (Alberta Research Council)

Terrestrial/Aquatic Subcommittee of APIGEC/SCAGE;

U.S. Canada Transboundary Air Pollution Impact Assessment Group

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Administration

ADMINISTRATION

In fiscal year 1980/81, all staff and financial systems of the former Research Secretariat and AOSERP were amalgamated. All RMD clerical staff is now under the direction of one office supervisor, and all RMD budgeting and administration are under the direction of one administrative officer. However, the officer administers two separate budgets: one for research in the oil sands regions and one for research in the non-oil sands regions. All system budgets are derived from meetings between administration and research managers and are based on research needs identified by line divisions.

Contract administration continues to profit from Master Agreements instituted in the 1978/79 budgetary year. They are standard format documents covering all agreements with a given institution, and specify the schedule of payments, the schedule of terms and conditions, and the schedule of insurance requirements. The RMD has such general-purpose agreements with the University of Alberta, the University of Calgary, and the Alberta Research Council. Whenever a member of any of these three institutions undertakes to do contract work for the RMD, only a letter of assignment is needed to cover the research work for his particular project. All other requirements and conditions are already covered in the Master Agreement with his institution. The agreements have succeeded in reducing the red tape necessary to initiate and formalize research projects. They guarantee consistency of terms and conditions in several contracts with a given institution.

A continuing project has been the consolidation of RMD files under the Alberta Government Services coding scheme, and mechanization

of the coding manual to facilitate updates. A revised listing is now being distributed quarterly.

Word processing has become a major component of RMD's activity. All lists, report drafts, and form letters, have been entered into the Advanced Text Management System (ATMS) to make more efficient use of human resources. In fact, the ATMS is now routinely used for all major typing projects.

Secretariat administrative staff made a number of site visits to become more familiar with field operations by researchers, and to observe laboratory techniques. Spot audits will continue as standard practice and may be expanded to include all contracts.

Two manuscripts, one on bioengineering for land reclamation and conservation, and the other on methane generation and recovery from landfills, received from researchers in previous years and deemed worthy of wider distribution were published. The administrative staff approached several publishing houses, and finally tendered the manuscripts to the University of Alberta Press and Ann Arbor Science Publishers Inc. They have since appeared in book form.

PUBLICATIONS

Emcon Associates for Consolidated Concrete Limited and Alberta Environment. 1980. Methane generation and recovery from landfills. Ann Arbor Science Publishers Inc., Ann Arbor, Michigan. 139 pp.

Schiechtl, H. 1980. Bioengineering for land reclamation and conservation. Edmonton: The University of Alberta Press, Edmonton. 404 pp.

Original with 1981-82 Annual Review
(82-11)

Library

LIBRARY

The Library Services Branch provides research support and reference service to Alberta Environment staff throughout the province. The library is also open to members of the public who have an interest in the environmental sciences.

The library is responsible for the maintenance and on-going development of an extensive collection of environmental reports and periodicals. At present, the library collection holds over 25 000 books and reports, and over 600 journal subscriptions are received throughout the province. Other services include the ordering of all paid publications, including journals for departamental staff; the provision of reference and interlibrary loan service; and the development of regional office library service, as required.

The main library collection is located in Edmonton; a branch library has been developed for the Calgary regional office, and two office collections exist in Lethbridge. The library is also assisting the Peace River regional office in establishing a reading room for a small book and periodical collection. It is cooperating with the library of the Alberta Environmental Centre in Vegreville, sharing resources be means of the interlibrary loan service. The AECV library is now fully established and on its own.

Use of the library's resources continues to increase. More than 11 000 people used the library in the fiscal year 1980/81, and asked 4428 directional and quick-reference questions. In addition, library staff provided in-depth information for 336 questions, including 50 on-line bibliographic data base searches. As always, interlibrary loan service played an important role in providing access to other

collections: over 500 items were requested from the University of Alberta and other libraries. In addition, other agencies' libraries and consultants borrowed 1475 publications from the Environment Library, an increase of 93% since 1977/78.

Many computer searches on specific topics were completed for departmental staff using the library's terminal facilities. Regional offices relied heavily upon the main library's collection and services. Regular service to the University of Alberta Library System, reinstated in the fiscal year 1979/80 through the instigation of the Alberta Provincial Government Libraries Interlibrary Loan Service, is continuing.

Following the recommendations of a 1979 feasibility study, the departmental libraries of Environment, Agriculture, and the Alberta Research Council, employed a consultant to proceed with the development of the SCI/TECH project, i.e., an automated cataloguing, circulation, and acquisition system. To date, sample printed indexes and microfiche have been produced for 200 items from the Calgary regional office library. Coding and inputting of information for the balance of the Calgary collection is continuing.

The comprehensive Bibliography of the Athabasca Oil Sands Fort McMurray, Alberta Area: Socio-economic and Environmental Studies, published in January 1980, is now being updated. The original 1900 items relating to the socio-economic and environmental aspects of oil sands development will be expanded to include 700 new titles, and the supplement will be available by the summer of 1981.

PROJECTS

SCI/TECH Data Bank.

Funding:	$70 000 by Alberta Environment Library, Alberta Agriculture Library, and Alberta Research Council Library.
Managed by:	SCI/TECH Data Bank Committee
Administered by:	SCI/TECH Data Bank Committee
Status:	Ongoing

PUBLICATIONS

Sanford, C. 1981. A bibliography of the Athabasca Oil Sands Fort McMurray Alberta area: socio-economic and environmental aspects: 1981 Supplement. Alberta Environment Library, Edmonton. 150 pp.

Kennedy, I. 1980. Final proposal for development of the SCI/TECH Data Bank, Phase II-III. Library and Information Consultants Ltd., Edmonton. 50 pp.

Kennedy, I. 1980. SCI/TECH Data base; Phase II: evaluation report. Library and Information Consultants Ltd., Edmonton. 55 pp.

POOR

QUALITY

ORIGINAL